EVALUATION OF COLOR AND LIGHTING PREFERENCES IN ARCHITECTS' OFFICES FOR ENHANCING PRODUCTIVITY

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ABSTRACT

Background: Knowledge of design basics is key to the successful planning and implementation of any interior design project. The elements and principles of design represent general, universal ideas that refer to every aspect of design.

Aim: This paper is focusing on occupant's Preferences regarding to Color and Lighting in the Architects' offices in Iran and India to increase the level of personalization in work environment and improving the Productivity. The outcome of this research would establish the link between architectural elements and Productivity. Moreover, the study would give clear indicators for the future architects to have a base for understanding the requirements and produce architectural components to suit to their specific requirements.

Methodology: The data was primarily sourced through a self-administered survey questionnaire using random sampling method on representative sampling basis.

Result: The finding of the study indicated that for employees in offices there are wide variety of Preferences in case of Color and Lighting. Also the outcome reveals employee's Productivity in architects' offices is affected by architectural elements.

Conclusion: There are different Preferences regarding Colour and Lighting for employees in architects' offices under the study. This difference would depend on distinction among behavioural, attitudinal and emotional pattern of the individuals. The result is based on the user's subjective impression and personal Preferences in case of Colour and Lighting.

Key Words: Architects' office, Preferences, Colour, Lighting, Productivity

INTRODUCTION

Knowledge of design basics is the key to the successful planning and implementation of any interior design project. The elements and principles of design would create general and universal ideas which apply to every aspect of design. Once designers understand how people perceive and react to their environments, they can use the elements and principles of design to form a whole composition.

cA design is created with these elements; Light, form, Color, shape, space, texture. They can be elements that make up a painting, drawing and totally create any work of art. Also a successful interior design, as an important part of human's life would be the result of combination and cooperation of these components.

The purpose of this study is to identify employee's Preferences in the Architects' office interiors in case of Color and Lighting to increase the level of personalization in workplace and improve the employees' Productivity.

The term of personalization applied in this study refers to utilization of the user's desires, choices and Preferences regarding Color and Lighting in work space. The literature reveals that personalization has a positive effect on employees' Productivity, and the same assumption is being tested in this study for the offices. The area chosen is the Architects' offices in Iran and India. The study will be based on primary data collected through a structured questionnaire.

LITERATURE REVIEW

In recent years, many designers were experimented with new ideas and methods to make work spaces more productive and attract more employees. Many authors have mentioned that, the physical setting of the workspace, along with successful

management techniques, is participating in enhancing employees' Productivity and improving organizational efficiency [1,2,3].

Colour performs a crucial part to the factors of environmental design such as concept, atmosphere, perform, built shape, location, and orientation. Therefore, the correct application of Colour can enhance users' capability to communicate with their atmosphere effectively. In addition, Color as a design device is appropriate for introducing the aesthetical, representational or cultural implications of the surroundings by the proper utilization of Color mixture[4].

Variety of Lighting in one's office would make a very significant contribution to the overall satisfaction that a building occupier and customer will experience. Visual comfort in a room will rely on the Lighting of areas such as light sources inside the area of view. If areas are too shiny or the contrast amongst lit areas is too high this will make glare. His research that personal control over an individual's work table has a positive impact on their convenience and inspiration. Individual control can be over shutters, the illuminance level on the table and the air conditioning of that area[5].

Recently, employee's comfort in work environment identified by workplace physical conditions, then environmental setting has been recognized as a significant issue for measuring their Productivity. According to a survey study on U.S. companies' employees determined that any improvement in physical layout of workplace, would direct the organization to greater overall effectiveness. A number of them could possibly be capable to expand the work-hours and keep working for a bit longer, due to the fact that the re-design and upgrade of the physical surroundings make them happier. Some of the factors which can help are: increase open space, use or allow adjustable furniture, increasing the privacy and reduce the eye-contacts during working hours, etc[6].

RESEARCH METHODOLOGY

The purpose of the study is to find out the employees' Preferences in case of Color and Lighting in the Architects' office interiors to increase the level of personalization and improve employees' Productivity.

The objectives of this study are:

- To identify the influence of architectural elements on employees' Productivity,
- To determine the employee's Preferences regarding to Color and Lighting in office interior to increase the level of personalization and improve Productivity

The Architects' office interior in Iran and India has been chosen as the population for the study. The formula used for sample size is (Kothari, 2006):

$$N = (z^2 . p . q . NU) / (e^2 (N_U - 1) + z^2 . p . q).$$

Where,

p = Proportion of defectives in the universe (Based on the pilot study, a 2% defect is assumed).

q = (1 − p).

z = 1.96 (as per table of scores in a normal distribution within a selected range of z for a confidence level of 95%).

e = Acceptable Error (an error of 2% of the true value is assumed).

N_U = Size of Universe.

The primary data for the survey was collected from 202 employees. The sample size was chosen based on representative sampling technique, ensuring that the group consisted of individuals' representative employees in different age, education and gender group. The result will be more reliable and help researchers in case of generalization. In this study a self-administered questionnaires have been administered with two type of questions: 1- Multiple choice questions, 2- Likert scale questions. The data which is collected through the survey is based on the workers' opinions about the workplace and its impact on their quantitative output of Productivity.

Based on the literature review, the relationship between elements of office interior design and Productivity is conceptualized and depicted in Figure 1.
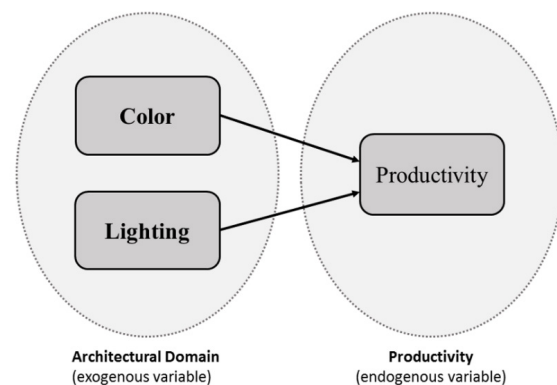

Figure 1: Conceptual framework

Thus, this research study explores the following research hypotheses;

H₁; Color selection in the interior design has a significant influence on Productivity.

H₂; Lighting selection in the interior design has a significant influence on Productivity.

RESEARCH FINDINGS

The questionnaire administered for this study, consist of three sections:

I. Collecting the demographic information from 202 employees ,

II. Is concerned with employees'Preferences in case of Color and Lighting in form of 'multiple-choice answer' and 'Likert scale' questions.

III. Questions in this part are asking about their existing working environment with respect to Productivity.

Section I: Demographic Information

In the first part; demographic information is gathered from the 202 employees from both countries, who answered the questionnaire. The mode of delivery was through online and hardy copy form, in two types; Persian and English questionnaires. Their gender, age, education profile are asked in the first 3 questions, as shown in tables 1 to 4.

Table 1: Respondents' Nationality

Nationality	Total.no	Total %
Iranian	112	55%
Indian	90	45%
Total	202	100%

Table 2: Gender

Gender Size	Total.no	Total %
Female	129	64%
Male	73	36%
Total	202	100%

Table 3: Age Group

Age	Total No	Total %
<25	76	38%
25-34	94	46%
35-45	22	11%
>45	10	5%
Total	202	100%

Table 4: Education Profile

Education	Total no	Total %
Diploma	13	7%
UG	105	52%
PG	71	35%
Professional	12	6%
Total	202	100%

According to tables 1 to 4, around 55% of respondents are Indians. Most of the respondents in survey are female (64%). About 46% of the attendees are between 25 to 34 years old and 52% of the employees have at least undergraduate degree.

Section II: Employees' Preferences in case of Color and Lighting

This section briefly discusses the survey findings regarding to employees' Preferences in the Architects' office interior in terms of Color and Lighting. Morever, there are some questions concerns with the employees' opinion regarding to importance and influences of Color and Lighting. The contents of this section have been covered in form of "Multiple-Choice Answer" and "Likert scale" questions.

According to research findings, Blue is one of the most popular Colors, especially between men. Blues and greens have a soothing and calming effect and red environment would increase the blood pressure and persuade people to be more active. Too much red would result anger and too much cool Colors may reduce Productivity. Of course designer have to make sure that there's a good balance between the Colors. Overusing of any group of Colors – warm or cool- can veer towards nauseating

Light Color scheme were cited as favorite of the preferred Color scheme in the survey. This study hypothesized that employees in the light Color scheme would experience greater job satisfaction and more Productivity will be demonstrated.

Among three neutral Color, white is the most appropriate Color in work environment, according to respondent Preferences (black is the worst selection), because it is light, neutral, and matches with everything.

According to survey results, Most of the respondents prefer to work in a room lighted by ambient Lighting in white Color, which gives the opportunity for personal control. There has been growing interest in whether employee control (or lack of control) over Lighting at work can impact on well-being and performance[7].

Section III, evaluation of employees' Productivity in their existing working environment

This section in concerning with employee's existing working environment. Their work hours and time management have been asked in three first questions.

According to data collected about exiting Productivity of the employees, they are wasting around 25% of their work hours as free times. That's because of access to social media, drinking coffee, walking around, etc. Generally this time is between 15% to 50% in offices in the world. In a survey by Salary.Com, 35% of employees responding said the number

one reason for slacking at work was that they don't feel challenged enough in their job.

Around 82% of respondents mentioned they are able to finish their assignment in their work hours. They also remarked "unpleasant working environment" as the reason of incompletion their assignment (67%), for the rest "Managerial problem" was the maincause.

The rest of the questions in form of Likert scale type, are concerning with their opinion about working in their desired environment- according to their selection of Color and Lighting- and the impact of this environment on their Productivity. The result would be discussed in next section.

RESULT

The study has established on three objectives, in connection to influences of architectural elements on employees' Productivity. Each part in this section would answer to each particular objective.

Objective no.1; To identify the influence of architectural elements on employees' Productivity.

Table 5: ANOVA, to identify influences of architectural elements on Productivity.

Employees Productivity Independent variable; Architectural Elements					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	67.589	19	3.557	10.379	.000
Within Groups	62.380	182	.343		
Total	129.969	201			

According to in table 5, there is a significant influence of architectural elements on employee's Productivity as per the significance value. Table 6.2 represent the effects of Lighting and Color on Productivity. The positive relationship between Lighting and Productivity (R = 0.730) at 0.01 shows that employees' Productivity highly correlates to the Lighting conditions and Color contents in the Architects' offices.

Table 6: Regression Results of Model

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.730[a]	.684	.683	.62189

Model B	Unstandardized Coefficients		Standardized Coefficients			
	Std. Error	Beta			t	Sig.
1 (Constant)	.945	.260			3.628	.000
Lighting	.351	.074	.317		4.721	.000
Color	.383	.065	.399		5.938	.000

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	73.006	2	26.503	68.527	.000[b]
Residual	76.963	199	.387		
Total	129.969	201			

df= degree of freedom, F=regression mean square/residual mean square ,Sig=P-value
a. Predictors: (Constant), Color, Lighting
b. Dependent Variable: Productivity

As indicated in table 6, the coefficient of determination R. square = 0.684. This gives us the ratio of explained variation to total variation. On converting the R. square value to percentage it comes to be approximately 68 Percent. From this percentage it is concluded that 68 percent of the variability of employees' Productivity is accounted for by the variables in this model.

The regression and residual sums of squares indicated that the variation in Ra is explained by the model to about 56%.

The regression co-efficient for the predictor variables; Color and Lighting are 0.383 and 0.351, respectively. The coefficient values show, the change in Productivity with a unit change in a variable value, when all the other variables are held constant. When we analyze the coefficient value for the variable, 'Color' we can say that there is an increase of 0.383 in the Productivity of an employee for every unit increase (betterment) in the Color contents of the office, keeping all the other variables constant.

The Regression Equation:

Employees' Productivity= 0.945 + 0.383 Color + 0.351 Lighting

The overall response for each factor was analyzed and the mean and standard deviation values are shown in the Table 7.

Table 7: Mean, STDEV, T-Values, P-Values

	Sample mean (M)	Standard Error(STERR)	T Statistics (|O/STERR|)	P Values
Color	0.333	0.088	3.757	0.000
Lighting	0.402	0.066	6.037	0.000

According to the findings from the survey in Table 7, T-statistic and P-value, indicate that in 1% significance level, Color and Lighting have effects on employees' Productivity, then the hypotheses are supported.

H_1; Color selection in the interior design has a significant influence on Productivity.

H_2; Lighting selection in the interior design has a significant influence on Productivity.

Objective no 2; To determine the employee's Preferences regarding to Color and Lighting in office interior to increase the level of personalization at work and improve Productivity

Table 8 shows the results concern with the employee's Preferences regarding to Color contents and Lighting condition in the Architects' offices;

Table 8: Employee's Preferences regarding to Color and Lighting

Variables	Preferences	
Most Favorite Colors	Blue	35%
	Red	16%
	Green	11%
Least Favorite Colors	Brown	18%
	Pink	18%
	Yellow	16%
Favorite scheme	Light colors scheme	61%
	Bright colors scheme	20%
	Dull colors scheme	11%
Favorite Neutral Colors	Black color	3%
	White color	70%
	Grey color	27%
Color Combination	Combination of cool colors	21%
	Combination of warm colors	11%
	Combination of cool and warm colors	68%
Favorite Type of Artificial Lighting	Ambient lighting with personal control	70%
	Ambient lighting without personal control	12%
	Task lighting	18%
Favorite color for lighting source	Blue Light	3%
	White Light	86%
	Yellow Light	11%

CONCLUSION

The main goal of interior architecture is to improve the quality of life, with respect to interior space. There are many parameters shaping the working or living space, but this research only considering the Color and Lighting and intend to create office interiors with human Preferences regarding to these elements. That can be a new definition of personalization in the Architects' offices. Personalization would create a sense of belonging for the employees and increase the level of satisfaction and enjoyment during the work time.

The outcome of this research established the link between the architectural elements, particularly Color and Lighting-and Productivity in the Architects' office interior.

Further, research demonstrates that the creation and preservation of an interior space is required to consider people preferences and attempt to increase the sense of well -being by attention to their personal opinions regarding working physical environment. Different employees with different characters can be observed in the workspace which had various selection and Preferences regarding Color and Lighting. If designers wanted to create suitable environment for the space users, they must firstly understand their needs, nature of their job and their choices in work environment. A person will be happy in a particular environment only when the interior stands for his Preferences and wishes.

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